

**The Palaearctic catalogue of Ptiliidae (Insecta, Coleoptera) - corrections
and additions to nomenclature and distribution records, with notes on taxic diversity
and distribution patterns**

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Abstract. Supplementing the new edition of the catalogue of Palaearctic Ptiliidae (Sörensson 2015) information on taxonomy, nomenclature and distribution of Palaearctic Ptiliidae is provided. *Trichopteryx myrmicophila* Motschulsky, 1845 is resurrected from synonymy of *Ptenidium formicetorum* Kraatz, 1851 due to recognition of original spelling and, thus, non-homonymy of *T. myrmecophila* Allibert, 1844. Authorship of *Millidium minutissimum* (Weber et Mohr, 1804), type species of *Millidium* Motschulsky, 1855, is corrected. Original spelling of *Ptiliolum orientale* Polilov, 2008 and *P. nemtsevi* Polilov et Bibin, 2004 is decided according to the zoological Code (ICZN 1999). Further corrigenda to Johnson (2004) are provided. Doubtful distribution records are commented upon. Distribution details are given on 102 species taxa, incl. ca 290 national records for Albania, Armenia, Austria, Belarus, Belgium, Bosnia Herzegovina, Bulgaria, Canary Islands, Croatia, Czech Rep., Denmark, Estonia, Finland, France, Germany, Georgia, Greece, Hungary, Italy, Kazakhstan, Latvia, Lithuania, Luxembourg, Montenegro, The Netherlands, Norway, Poland, Portugal, Romania, Russia, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey, Ukraine, Algeria, Tunisia, China, Cyprus, Israel, Japan, Mongolia, Syria and Tadzhikistan. Altogether 33 new species and 3 new genera of Palaearctic Ptiliidae have been described or recognized since Johnson (2004) making a total of 215 species in 34 genera known from the Palaearctic realm (Europe: 139 species; North Africa: 54; Asian region: 117). Comments on distribution patterns, taxon richness and biogeography are provided.

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1. INTRODUCTION

Taxa of the staphylinoid beetle family Ptiliidae (Featherwing beetles) were catalogued in a complete treatment of the Palaearctic fauna in Johnson (2004), thereby replacing the long outdated catalogue of Winkler (1925). Altogether, 182 valid species names in 26 genera were recognized. This work was supplemented by detailed comments (Johnson 2001, 2003) and by subsequent corrections and additions (Johnson 2007a, 2007b, 2008a, 2008b, 2010, 2011; Vorst 2007a; Vorst & Sörensson 2006) adding a further four valid species names (*Ptiliola flammifera* (Mlynarski, 1985), *Cissidium matthewsi* Johnson 2007, *Acrotrichis nana* Strand, 1946, *Acrotrichis williamsi* Johnson, 2007) to a total of 186.

During preparation of a new edition of the Catalogue of Palaearctic Ptiliidae (Sörensson 2015) new information on taxonomy, nomenclature and distribution of Palaearctic Ptiliidae has been unveiled. In addition, new taxa have been described or recorded from the area not mentioned in Johnson (2004) and its supplements, thus, raising the total number of genera to 34 and valid species names to 215, increases by 30.8% and 18.1% respectively, over only 11 years.

The main purpose of this paper is to summarize new information on taxonomy, distribution and nomenclature of Palaearctic Ptiliidae gathered since Johnson (2004). In addition, previously overlooked problems as to nomenclature, taxonomy, distribution and references are discussed and corrected when necessary. This work is a part of an overall ambition of updating the taxonomic nomenclature of Ptiliidae in order to provide a modern working tool for the systematist. As to the nomenclature, the present work continues focusing on finding and listing all names of ptiliid taxa regardless of availability. Priority is given to adapting and conforming the existing nomenclature to the current rules of the Zoological Code (ICZN 1999). This work has yielded a number of cases and nomenclatural problems in need of solution a few of which are considered below.

As far as possible, the taxonomical nomenclature, including synonyms, original spellings, authorship of names and year of description, forgotten names, misidentifications and various kinds of lapsi have been scrutinized and, where needed, corrected or commented upon. In addition, missing distribution records have been added and dubious records deleted or commented upon. Primary taxonomical references have been updated or corrected when needed. We may certainly expect further changes and corrections pertaining to nomenclature, taxonomy and distribution in the future.

2. MATERIAL AND METHODS

The information on Ptiliidae as presented here was gathered from literature sources or by examination of physical specimens in public or private collections (*vide* chapter 4.3). Literature records were gathered from various standard sources, like the Zoological Record, by dissemination of references via colleagues and by random search in libraries. Physical specimens of Ptiliidae were investigated *in situ* in museum collections or, via loans, at the Biological Institution in Lund. Specimens, dry-mounted or in alcohol, were usually examined under a standard Zeiss stereo microscope under 80X magnification, or, when necessary, by transparent whole-mounts on slides. Examined specimens were supplied by a printed determination label attached with my signature and year of date. All data extracted from the determination process (species, sex, number of specimens, label data) were noted in handwritten files. Specimens seen and identified by me are deposited in collections as listed below (*vide* Acronyms). When possible, voucher specimens were deposited in my private collection (coll. Sörensson, Lund).

Nomenclatural decisions and acts as presented below were drawn from a careful analysis of a large number of literature sources, also involving references overlooked or neglected in standard works on Ptiliidae.

Acronyms:

DEIE Deutsche Entomologische Institut, Eberswalde, Germany;
MCNG Museo Civico di Storia Naturale, Genova, Italy;
MHNG Museum d'Histoire Naturelle, Genève, Switzerland;
MHUB Museum für Naturkunde der Humboldt-Universität, Berlin, Germany;
MNHB Museum of Natural History, Budapest, Hungary;
MNHS Museum of Natural History, Stockholm, Sweden;
NISK Norsk Institutt for Skogforsking, coll. E. Sundt, Ås, Norway;
SMNS Staatliches Museum für Naturkunde, Stuttgart, Germany;
ZMLM Zoological Museum of the Lomonosov University, Moscow, Russia;
ZMUB Zoological Museum of the University, Bergen, Norway;
ZMUH Zoological Museum of the University, Helsinki, Finland;
ZMUL Zoological Museum of the University, Lund, Sweden;
ZMUO Zoological Museum of the University, Oslo, Denmark;
cAL coll. Albena Lapeva-Gjonova (Sofia, Bulgaria);
cAB coll. Arvids Barševskis (Daugavpils, Latvia);
cANN coll. Anders N. Nilsson (Mullsjö, Sweden);
cAP coll. Andreas Pütz (Eisenhüttenstadt, Germany);
cBS coll. Bjørn Sagvolden (Rollag, Norway);
cFA coll. Fernando Angelini (Brindisi, Italy);
cGR coll. Gordon Ramel (Kerkini, Greece);
cIAS coll. I. A. Solodovnikov (Vitebsk, Belarus);
cIS coll. Israel de Faria e Silva (Lisboa, Portugal);
cJO coll. Jan Olsson (Vallentuna, Sweden);

cMB	coll. Milan Boukal (Pardubice, Czech Republic);
cMM	coll. Marion Mantič (Bobrovníky, Czech Republic);
cMS	coll. Mikael Sörensson (Lund, Sweden);
cMSb	coll. Max Sieber (Grossschönau, Germany);
cON	coll. Oto Nakládal (Praha, Czech Republic);
cPH	coll. Peter Hlaváč (Praha, Czech Republic);
cPJ	coll. Paweł Jałoszynski (Poznań, Poland);
cPR	coll. Philippe Reisdorf (Boullay-les-Troux, France);
cRG	coll. Robert Gawronski (Morąg, Poland);
cRO	coll. Raimundo Outerelo (Madrid, Spain);
cRS	coll. Rudolf Schuh (Katzelsdorf, Austria);
cSL	coll. Stig Lundberg (Luleå, Sweden);
cYM	coll. Yura Marusik (Magadan, Russia).

3. NOMENCLATURAL CORRECTIONS

3.1. Non-homonymy in one-vowel difference

Ptenidium myrmicophilum (Motschulsky, 1845) is hereby resurrected from its junior synonymy of *Ptenidium formicetorum* Kraatz, 1851.

Motschulsky (1844) briefly mentioned *Trichopteryx myrmicophila* [as in *Trychopteryx* (misspelling)] in a paper dealing with myrmecophilous insects. In a subsequent paper, Motschulsky (1845: 518) provided an elaborate description based on a large number of specimens found by ants ("*Formica rufa major*") in northern Russia. In both works, he consistently used *myrmicophila* as the original spelling and at least four times. The species was transferred to the genus *Ptenidium* Erichson, 1845 by Allibert (1847) where it now resides.

Fournel & Gehin (1846) were the first authors other than Motschulsky to cite the name in its original spelling. Without any express reason Allibert (1847), however, emended the spelling to *myrmecophilum* and provided a replacement name, *motschulskii* Allibert, 1847 because of its presumed homonymy of *T. myrmecophila* Allibert, 1844 (now in *Ptilium* Gyllenhal, 1827). Most other authors accepted Allibert's emended spelling, exceptions being e.g. Fournel & Gehin (1846). From Allibert's original text, it cannot be definitely decided whether the changed spelling actually was intentional or the result only of a lapsus. Here, it is regarded as a plain misspelling and thus unintentional and of no formal standing.

Kraatz (1851) described *Ptenidium formicetorum* Kraatz, 1851 as a new species found in ant heaps, simultaneously stating that his new species might be conspecific to Motschulsky's species. *Ptenidium formicetorum* Kraatz was immediately recognized as a valid species in Central European literature, e.g. Dohrn (1852, 1855), Lacordaire (1854), Jacquelin du Val (1857), Schaum (1859) and Crotch (1863).

Due to general neglect of Motschulsky's work *Ptenidium myrmicophilum* (usually misspelled as *myrmecophilum*) remained largely unknown in Europe until it was first recognized as valid by Marseul (1857, 1863). It gained, however, not general acceptance

as senior among European authors until Flach underlined its seniority in his family revision (Flach 1889b), followed by other influential works such as Reitter (1891, 1906, 1909), Ganglbauer (1898), the world catalogue of Ptiliidae (Csiki 1911), Kuhnt (1913), Łomnicki (1913), Everts (1922), Roubal (1930), the Palaearctic catalogue of Ptiliidae (Winkler 1925) and many faunistic works.

Although applied in Johnson (2004) and Sörensson (2015), the original spelling [*myrmicophilum*] prevailed mainly in the Polish and Russian tradition which correctly recognized the fundamental stem vowel difference (Burakowski *et al.* 1978; Jakobson 1910; Majewski 1994; Mroczkowski & Stefanska 1991; Nikitsky *et al.* 2008) while Allibert's emending was uncritically followed by others, like in the standard West and Central European coleoptera literature (Arnold 1974; Besuchet 1971; Franz 1965, 1970; Hansen 1968; Horion 1949, 1951; Joy 1932; Lucht 1987). For a long time, thus, two competing traditions of spelling prevailed side by side calling for ruling.

In modern time, Pope (1977) and Silfverberg (1979) seems to be the first to reinvoke the old misconception of primary homonymy of Allibert's and Motschulsky's names. Pope's list of Ptliidae apparently lent considerably on an unpublished taxon list by Colin Johnson since he speaks of a 'ready-made' list provided by Johnson during the preparation of the new check list (Pope 1977: xiv). Based on Allibert's deliberate emending and the subsequent misspelling of Motschulsky's name *Ptenidium formicetorum* Kraatz, 1851 was relaunched as a replacement name, however, without taking Allibert's senior replacement name *Trichopteryx motschulskii* Allibert, 1847, the oldest available junior synonym, into consideration. Except for Polish authors (*vide* above), this action was accepted and often cited in European checklists and faunistic works.

Since the spelling of *myrmicophilum* vs *myrmecophilum* has been, and still is, fluctuating in the literature it calls for stabilization. The formation and treatment of names is ruled in Chapter 7, Articles 25-34 while homonymy is treated in chapter 12, Articles 52-60 of the Zoological Code (ICZN 1999).

Article 32.2. Correct original spelling. The original spelling of a name is the "correct original spelling", unless it is demonstrably incorrect as provided in Article 32.5.

Article 32.5.1. If there is in the original publication itself, without recourse to any external source of information, clear evidence of an inadvertent error, such as lapsus calami or a copyist's or printer's error, it must be corrected. Incorrect transliteration or latinization, or use of an inappropriate connecting vowel, are not to be considered inadvertent errors.

Article 57.6. One-letter difference. Except as specified in Article 58, a one-letter difference between species-group names combined with the same generic name is sufficient to prevent homonymy.

Article 58. Variant spellings of species-group names deemed to be identical. [Fifteen different cases are given, none of which applies in this case.]

From the cited articles, it is clear that *myrmecophilum* and *myrmicophilum* cannot be regarded as homonyms. This is also supported by the fact that the linguistic roots seem to be different. The adjective *myrmecophilum* is derived from the Greek word ‘myrmex’, ‘myrmek|os’ while *myrmicophilum* is derived from the latinized word ‘myrmica’, ‘myrmic|is’. Thus, the conclusion must be that no homonymy is involved and that from two competing variant spellings in current use the one corresponding to the correct, original spelling, i.e. ‘*myrmicophilum*’, should be regarded as valid while the subsequent emended spelling ‘*myrmecophilum*’ should be regarded as an incorrect subsequent spelling and of no formal standing in the scientific literature; cfr. Article 33 (ICZN 1999).

3.2. Correction of authorship

For more than 200 years there has been confusion regarding the authorship of *Millidium minutissimum* (Weber et Mohr, 1804), originally described as *Elophorus minutissimus* Weber et Mohr 1804, also being the type species of the genus *Millidium* Motschulsky, 1855.

The species was briefly described in Weber & Mohr’s Swedish itinerary (Weber & Mohr 1804) based on material present in the collection of S. I. Ljungh. This circumstance caused subsequent authors to assume that Ljungh was the original auctor of the name, e.g. Gemminger & de Harold (1868), Csiki (1911), Horion (1949), Besuchet (1971), Johnson (2004) and many others. On the other hand, Motschulsky (1845), Matthews (1872), Burakowski *et al.* (1978), Hansen (1996) and others considered Weber & Mohr (or Weber alone) as the correct auctor.

The long-term uncertainty as to the original authorship calls for decision. The correct authorship is Weber & Mohr, which is clearly stated in the original text (Weber & Mohr 1804).

3.3. Gender of species name to be corrected

Ptiliolum orientale Polilov, 2008. Originally described as *P. orientalis* (Polilov 2008: 169). The species name is an adjective of the third declension and takes the ending ‘-e’ in neuter. According to Article 31.2 and 34.2 of the Zoological Code (ICZN 1999) this type of adjectival species-group gender must agree with the generic gender. Thus, the corrected spelling is deemed to be *Ptiliolum orientale*.

3.4. Synonymic assignment to be corrected

Acrotrichis pubescens (Rey, 1889): remove from synonymy of *A. sericans* (Heer, 1841) and add as synonym of *A. thoracica* (Waltl, 1838); cfr Johnson (2001: 131) and Johnson (2004: 130).

3.5. Multiple original spellings to be corrected

Ptiliolum nemtsevi Polilov et Bibin, 2004. Polilov & Bibin (2004:151) described *Ptiliolum nemtsevi* n.sp. but used the spelling ‘*nemtsovi*’ three times on p. 150 and twice in

figure legend 1 on p. 152. Thus, introduction of a new name with inconsistent spelling calls for decision of use as implied by Article 24.2.3 and 32.2.1 (ICZN 1999). Since the new name *nemtsevi* was accompanied by a full description while *nemtsovi* was not, *nemtsevi* is hereby deemed to be the correct spelling and the combined name should be cited as:

Ptiliolum nemtsevi Polilov et Bibin, 2004: 151
nemtsovi Polilov et Bibin, 2004: 150, 152 [misspelling]

3.6. Subsequent misspelling to be corrected

Polilov (2008) described among others three species of Nanosellini assigning them to the genus *Porophila* Dybas, 1956, repeatedly misspelt, however, as ‘*Porophilla*’. In subsequent publications (Polilov 2015; Polilov & Beutel 2009), this spelling (*Porophilla sensu* Polilov) was continuously used giving the impression of a corrected original name or even a new genus group name. According to articles 19, 32 and 33 of the Code (ICZN 1999), *Porophilla sensu* Polilov could potentially be regarded as an unjustified emendation. However, since the use of the alternative spelling *Porophilla* was not accompanied by a “demonstrably intentional” explicit statement of correction (Article 33.2) it should simply be regarded as an incorrect subsequent spelling (Article 33.3) and thus not available in the zoological nomenclature.

3.7. Errata

Acrotrichis atomaria (De Geer, 1774): remove symbol [HN] under junior synonym *Dermestes minima* Marsham, 1802 (Johnson 2004: 128).

Acrotrichis grandicollis (Mannerheim, 1844): the correct spelling (gender) of junior synonym *Ips plumigerus* L’Hermina, 1791 under genus *Acrotrichis* Motschulsky (gender: feminine) is *A. plumigera* (Johnson 2004: 130); cfr. Johnson (2011: 24).

3.8. Doubtful assignments [DA]

Chrysomela minutissima Linnaeus, 1767 was doubtfully assigned to *Acrotrichis atomaria* (De Geer, 1774) as a synonym in Johnson (2004). Since no syntopic material has ever been located and the very brief description in fact applies to almost any genus of Ptiliidae (possibly also some non-ptiliid taxa) the name is a *nomen dubium*. Linnaeus and De Geer were in close contact during this period and it cannot be excluded that their species names actually refer to one and the same species.

3.9. Subgeneric assignments

Although Sawada & Hirowatari (2002a) and Polilov (2008) refrained from assigning their new species of *Acrotrichis* Motschulsky, 1845 to any known subgenus it can be inferred from the species descriptions that they most probably belong in the large nominal subgenus

Acrotrichis sensu stricto (vide above), the sole exception being *Acrotrichis latipedes* Sawada et Hirowatari, 2002 which obviously should be placed in the subgenus *Flachiana* Sundt, 1969. Thus, *A. kemae* Polilov, 2008, *A. meridiana* Sawada et Hirowatari, 2002, *A. pulchellipennis* Sawada et Hirowatari, 2002, *A. ryukyuensis* Sawada et Hirowatari, 2002 and *A. zhantievi* Polilov, 2008 are tentatively placed in *Acrotrichis sensu stricto*. This also goes for *Acrotrichis latipennis* Nakane, 1974, recently redescribed in Sawada (2010) (vide below) and previously assigned to *Acrotrichis sensu stricto* by Johnson (2004). Since the general definition of the subgenera of *Acrotrichis* and their systematic delimitations are weak and surely need to be revised based on a global scale, these assignments should be viewed as provisional.

3.10. New Palaearctic taxa

Since the previous edition of the catalogue (Johnson 2004) several new taxa have been recorded in the Palaearctic realm, 29 of them described as new. Since the original publications might be difficult to obtain a brief overview of all new Palaearctic ptiliid taxa are listed below, including their original references. The list follows the systematic order of the last catalogue (Johnson 2004). *Porophilla sensu* Polilov (2008) is an incorrect subsequent spelling of *Porophila* Dybas, 1956 (vide chapter 3.6 above). Assignments to subgenera of *Acrotrichis* Motschulsky made subsequently by me, i.e. not appearing in the original descriptive work, are marked by brackets (vide chapter 3.9 above).

PTILIINAE: NANOSELLINI

Cylindroselloides maritimus Polilov, 2008 described from Russian Far East (A: FE) (Polilov 2008).

Nanosella russica Polilov, 2008, described from Russian Far East (A: FE) (Polilov 2008).

Porophila cedri Polilov, 2008 [*Porophilla*, misspelling], described from Russian Far East (A: FE) (Polilov 2008).

Porophila lazovskii Polilov, 2008 [*Porophilla*, misspelling], described from Russian Far East (A: FE) (Polilov 2008).

Porophila mystacea Polilov, 2008 [*Porophilla*, misspelling], described from Russian Far East (A: FE) (Polilov 2008).

Primorskiella anodonta Polilov, 2008, described from Russian Far East (A: FE) (Polilov 2008).

Sikhote lumpia dersuuzalai Polilov, 2008, described from Russian Far East (A: FE) (Polilov 2008).

Ussuri lumpia trichaptumi Polilov, 2008, described from Russian Far East (A: FE) (Polilov 2008).

PTILIINAE: PTILIINI

Kuschelidium okinawense Sawada et Hirowatari, 2002, described from Japan (A: JA) (Sawada & Hirowatari 2002b).

Ptiliolum (s.str.) *nemtsevi* Polilov et Bibin, 2004, described from southern territory of Russia

(E: ST) (Polilov & Bibin 2004); *vide* chapter 3.5 above as to the correct spelling.

Ptiliolum (s.str.) *orientale* Polilov, 2008, described from Russian Far East (A: FE) (Polilov 2008); *vide* chapter 3.3 above as to the correct spelling.

Skidmorella amamiana Sawada et Hirowatari, 2003, described from Japan (A: JA) (Sawada & Hirowatari 2003).

Skidmorella quadrисulcua Sawada et Hirowatari, 2003, described from Japan (A: JA) (Sawada & Hirowatari 2003).

PTILIINAE: PTINELLINI

Cissidium elongatum Sawada, 2008, described from Japan (A: JA) (Sawada 2008).

Cissidium ikeuchii Sawada, 2008, described from Japan (A: JA) (Sawada 2008).

Cissidium ishigakiense Sawada, 2008, described from Japan (A: JA) (Sawada 2008).

Cissidium itoi Sawada, 2008, described from Japan (A: JA) (Sawada 2008).

Cissidium latum Sawada, 2008, described from Japan (A: JA) (Sawada 2008).

Cissidium nishikawai Sawada, 2008, described from Japan (A: JA) (Sawada 2008).

Cissidium nomurai Sawada, 2008, described from Japan (A: JA) (Sawada 2008).

Cissidium sakaii Sawada, 2008, described from Japan (A: JA) (Sawada 2008).

Cissidium shibatai Sawada, 2008, described from Japan (A: JA) (Sawada 2008).

Ptinella populicola Vorst, 2012, described from The Netherlands (E: NL) (Vorst 2012).

ACROTRICHINAE: ACROTRICHINI

Acrotrichis (s.str.) *kemae* Polilov, 2008, described from Russian Far East (A: FE) (Polilov 2008).

Acrotrichis (s.str.) *meridiana* Sawada et Hirowatari, 2002, described from Japan (A: JA) (Sawada & Hirowatari 2002a).

Acrotrichis (s.str.) *pulchellipennis* Sawada et Hirowatari, 2002, described from Japan (A: JA) (Sawada & Hirowatari 2002a).

Acrotrichis (s.str.) *ryukyuensis* Sawada et Hirowatari, 2002, described from Japan (A: JA) (Sawada & Hirowatari 2002a).

Acrotrichis (s.str.) *zhantievi* Polilov, 2008, described from Russian Far East (A: FE) (Polilov 2008).

Acrotrichis (Flachiana) latipedes Sawada et Hirowatari, 2002, described from Japan (A: JA) (Sawada & Hirowatari 2002a).

3.11. New references

Due to several recently described or detected ptiliid taxa from the Palaearctic, further primary taxonomical references should be added to the list of literature as given in Johnson (2004) and its supplements. They are: Dybas (1956), Johnson (1971), Polilov (2008), Polilov & Bibin (2004), Sawada (2008), Sawada & Hirowatari (2002a, 2002b, 2003) and Vorst (2012).

In addition, a few other references have been revised as to date of publication or in some other respect. In summary, the following references have been added or revised: Flach (1889a, 1889b), L'Hermina (1791), Redtenbacher (1847) and Weber & Mohr (1804).

4. DISTRIBUTION

4.1. Doubtful distribution records

Ptenidium matthewsi Flach, 1889. The record of *Ptenidium matthewsi* Flach, 1889 from Austria is probably erroneous due to misinterpretation of its misidentified synonym *Ptenidium punctulum* (Stephens, 1830), nowadays known as a junior synonym of the common compost species *P. pusillum* (Gyllenhal, 1808) (cfr. Horion 1935, 1949), formerly sometimes believed to be a synonym of *P. matthewsi*. *Ptenidium punctulum* was recorded from Oberösterreich by Dalla Torre (1879:81) and later cited from Austria in subsequent works, e.g. Schweiger (1951) and Hölzel (1961). Besuchet (1976) explained the confusion around these names. *Ptenidium matthewsi* is a strictly south-western Mediterranean wetland species, usually occurring in coastal marshes. The unlikely records for Austria needs rechecking.

Ptilium affine Erichson, 1845. In Johnson (2004) recorded from the northern territory of Russia [NT]. The record is based on a single specimen found by Stephan Platonoff near the Karelian village of Gumbaritsa at river Pelzuznya on 25.V.1943 (Palmén 1946), doubtfully assigned to this species by O. Renkenen and subsequently cited in the catalogues of Lindroth (1960) and Silfverberg (1979). In Lindroth (1960), *P. affine* is recorded for 'Karelia Olonetsensis', implying a finding site close to the lake Ladoga. As far as I know, this is the only mention of this Central European species from Russia, as there are no modern records. It is not known from surrounding areas. Since the presence in this part of Russia is unlikely the record needs confirmation and the original specimen should be critically checked.

Since long, *Ptilium affine* Erichson, 1845 (and *Ptilium caesum* Erichson, 1845) were recorded from Italy (Horion 1949; Poggi 1995). However, they are not mentioned for Italy by Besuchet (1971, 1976) in his revisionary work on European species of *Ptilium* Gyllenhal, thereby indicating doubt as to its presence. Due to close resemblance to other *Ptilium* species and high risk of confusion Italian records, thus, require confirmation.

Ptilium horioni Rosskothen, 1934. In Johnson (2004) recorded from the northern territory of Russia [NT]. The record is based on information as provided in the catalogue of Silfverberg (1979, 2010). Since the presence in north western Russia is disputable, the record needs confirmation.

Acrotrichis volans (Motschulsky, 1845). Listed from Poland in Johnson (2004), and also on the 'Coleoptera Poloniae' homepage (<http://coleoptera.ksib.pl>). Not mentioned by Mlynarski (1984) in his modern revision of the Polish *Acrotrichis* fauna. Obviously, Polish records are based on old literature records not verified or critically checked. Although recorded here for Germany (see below), the identity of the recent German record remains doubtful (Meybohm 2001). As the specific status of this northern taiga species is still not clarified (MS pers. obs.), Central European records should be critically evaluated.

4.2. Deleted distribution records

Acrotrichis latipennis Nakane, 1974. Nakane (1974) reported this species from Hokkaido

as “*Acrotrichis latipennis* Sundt (*in litt.*)” and provided a brief description. Apparently, Sundt’s intention of describing a new species named as “*Acrotrichis latipennis*” was never realized. What species Sundt actually had in mind is not known. The Sundt collection in Ås, Norway does not hold any material labelled as such. There is, however, a possibility that original material may be found in the Natural History Museum, London, where other Sundt types, both described and undescribed, were deposited.

Sawada (2010) redescribed *A. latipennis* Nakane, and provided illustrations of genitalia. He referred the species as belonging to the “*sericans*-group” of Sawada & Hirowatari (2002a).

Johnson (2004: 129) listed *A. latipennis* Nakane from Azerbaijan and Japan in the recent Palaearctic catalogue. This odd pattern of distribution is striking and possibly reflects inclusion of material seen by Sundt. Since there is no evidence as yet published, which supports the unlikely presence of *A. latipennis* in Azerbaijan it is deleted for Azerbaijan for the time being.

Acrotrichis rugulosa Rosskothen, 1935. Johnson (2004) listed this species from The Netherlands [NL]. Vorst (2008) showed that this record was based on misidentifications and therefore should be deleted; cfr. Vorst (2010).

Ptilium affine Erichson, 1845. According to Oscar Vorst (pers. comm.) the record for ‘Hollande’ as mentioned in Besuchet (1976) cannot be verified and should therefore be deleted; cfr. Vorst (2010).

4.3. New distribution records

Since the early 1980’s I have served the beetle community with identification aid of northern hemisphere Ptiliidae. Tens of thousands of specimens from museum collections, private collections, scientific expeditions and investigations have been studied, identified, labelled and catalogued, many of which have never been published or made public by other means. A wealth of new faunistic information has been revealed through this effort. Since a considerable part pertains to the Palaearctic fauna, I find it appropriate to include and single out all those records which add to our knowledge of their distribution.

Only records included in Sörensson (2015) and not previously included in Johnson (2004) and its supplements are presented. Later records will be treated in future supplements. As a service, those records already published elsewhere (but not included in Johnson’s catalogue) are briefly summarized (for simplicity only the collecting locality is cited) and their main references given in parenthesis. For previously unpublished records at least one locality/collecting site per country is cited (usually as it appears on the original pinned label), followed by date, collector, number of specimens and current location of preserved material (*vide* Acronyms), in a few cases also including brief notes on collecting circumstances. Specimen labels in Cyrillic letters were transcribed into Latin letters according to common practice. All new records are given in bold. Systematic order follows the Palaearctic catalogue (Johnson 2004; Sörensson 2015). Species, their numbers and relation to collecting history, tradition and geography is further discussed below.

Baranowskiella ehnstromi Sörensson, 1997. **Austria:** Tirol, Fritzens 2014 (Coray & Siede 2014). **Belgium:** Luxembourg, Guelff 9.iii.2014 (Coray & Siede 2014). **Denmark:** Jutland & Seeland 2012 and later (Hansen & Jørum 2014). **France:** Haut-Rhin, Leymen 9.ii.2014, and other localities (Coray & Siede 2014; Dodelin *et al.* 2015; Schultheis *et al.* 2014). **Germany:** Baden-Württemberg, Efringen-Kirchen 3.vii.2011, and other localities (Coray & Siede 2014). **Luxembourg:** several localities xii.2012-iii.2013 (Coray & Siede 2014). **Norway:** South and Central Norway, from 1994 and onwards (Andersen *et al.* 2003). **Switzerland:** Solothurn, Olten 6.xii.2009 (Coray & Siede 2014).

Nossidium flachi Ganglbauer, 1898. **Greece:** Macedonia, Pieria, Olympos mtn., Pronia 1200m. 29.v.2004 leg. R. Schuh 4 ex (cRS, cMS). **Montenegro:** Dalmatia, Castelnuovo M. Hilf 1910 leg. O. Leonhard 1 ex (cMS). **Slovakia:** Vurán-Cigánka, Vyžkum pro NP Múránska planina 22.v.2002 leg. M. Mantič 1 ex (cMM).

Nossidium pilosellum (Marsham, 1802). **Montenegro:** Dalmatia, Castelnuovo M. Hilf 1910 leg. O. Leonhard 1 ex (NISK).

Ptenidium nitidum (Heer, 1841). **Lithuania:** *vide* catalogue (Tamatit *et al.* 2011). **Russia [FE]:** Lazovskiy zap.; *vide* Polilov (2008).

Ptenidium reitteri (Flach, 1887). **Czech Republic:** Litovel env., NPR Vrapac 19.ii.2004 leg. O. Nakládal 1 ex (cON). **Montenegro:** Recorded from the former Yugoslavia [YU] in Johnson (2004), in reality being from Montenegro (Besuchet 1976:52). **The Netherlands:** Limburg and Noord-Brabant; *vide* Vorst (2007b). **Poland:** Posnan, Puszczykowo (Jałoszyński & Sörensson 2005). **Portugal:** Santarém distr., Golegã, Paúl Boquilobo Salgueiral, RNPB Nat. Res. 8.x.2002 leg. I. Silva 1 ex (cIS).

Ptenidium gressneri Erichson, 1845. **Latvia:** Moricsala 6.viii.1998 leg. N. Jansson 2 ex (cNJ). **Norway:** Larvik; *vide* Ødegaard *et al.* (2009). **Ukraine:** *vide* Mateleshko (2009).

Ptenidium laevigatum Erichson, 1845. **Bosnia Herzegovina:** Herzegovina 6 ex (ZMUC). **Slovakia:** Šarišské Bohdanovce 7.iv.1994 leg. P. Boža 1 ex (cMM).

Ptenidium laevipenne Abeille, 1904. **Portugal:** Ab. mer. reg. Faro, Nave 5.iii.2004 leg. M. Mantič 7 ex (cMM, cMS).

Ptenidium turgidum Thomson, 1855. **Bulgaria:** Nessebar 16.ix.1965 leg. T.-E. Leiler 1 ex (MNHS). **Latvia:** Slitere NR, Bluehills 7.vii.1997 leg. N. Jansson 1ex (cNJ). **Tunisia:** Ain Draham 2 ex (ZMUH).

Ptenidium fuscicorne Erichson, 1845. **Bulgaria:** Albena 27.viii.1983 leg. T. Palm 2 ex (ZMUL). **Greece:** Korfu, La Korission 8.x.1964 leg. T.-E. Leiler 2 ex (MNHS). **Algeria:** "Algerium" 1 ex (NISK).

Ptenidium longicorne Fuss, 1868. **Belarus:** st. Luschki, 12 km juv Bogushevska, Senn. r-n. 9.v.2000 leg. I. A. Solodovnikov 3 ex (cIAS) (cMS). **Denmark:** Knudskov; *vide* Sörensson (2007). **Georgia:** Mzcheta, p. Tbilisi 4-23.vi.1987 leg. Wrase/Schülke 1 ex (MHUB). **Portugal:** Santarém distr., Golegã, Paúl Boquilobo Salgueiral, RNPB Nat. Res. 8.x.2002 leg. I. Silva 4 ex (cIS, cMS). **Slovakia:** Opatovce; *vide* Nakládal *et al.* (2008). **Sweden:** Vassunda; *vide* Sörensson (2007).

Ptenidium myrmicophilum Motschulsky, 1845. **Bulgaria:** Nessebar 11.x.1965 leg. T.-E. Leiler 2 ex (MNHS). **Greece:** Sdl. Sporaden, Nikania 7-12.vii.1887 leg. v. Oertzen 1 ex (MHUB).

Luxembourg: Enneschte Bësch; *vide* Köhler (2011). **Russia [ST]:** Guzeripl; *vide* Polilov & Bibin (2004). **Cyprus:** Kyrenia 22.ii-14.iii.1956 leg. T. Palm 21 ex (ZMUL).

Ptenidium punctatum (Gyllenhal, 1827). **Latvia:** Klapkalneiens; *vide* Vorst *et al.* (2007). **Portugal:** Quarteira 2.iii.2004 leg. M. Mantič 2 ex (cMM). **Russia [FE]:** Ryazanovka; *vide* Polilov (2008).

Ptenidium pusillum (Gyllenhal, 1808). **Montenegro:** Savina leg. Paganetti 1 ex (ZMUB). **Israel:** Haifa, leg. Reitter 1 ex [labelled as "Syrien KaIfa"] (DEIE). According to I. Löbl (pers. comm.) the locality probably refers to Haifa in Israel. This common compost species certainly occurs in Israel; cfr. Johnson (2004).

Ptenidium brenskei Flach, 1887. **Romania:** jud. Maramures, Petrova, Vișeu riv. 17.viii.2003 leg. G. Makranczy 1 ex (MNHB).

Ptenidium intermedium Wankowicz, 1869. **Czech Republic:** Ostrava env., *vide* Nakládal & Sörensson (2008). **Finland:** Turku, *vide* Kuntsi & Norrdahl (2015). **Greece:** Poiudroso 10.v.1994 1150 m. leg. Sabella "rive torr." 2 ex (cFA, CMS). **Russia [ST]:** Sotji, Tsheerlova Nora cave 9.viii.1994-1.viii.1996 leg. A. Koval, 1 ex. (ZMLM). **Ukraine:** *vide* Mateleshko (2009).

Actidium boudieri (Allibert, 1844). **Latvia:** Ilgas 11.vi.1996 leg. A. Barševskis 1 ex (cAB) (Barševskis 2001).

Actidium coarctatum (Haliday, 1855). **Bosnia Herzegovina:** Sutorine leg. Paganetti 2 ex (ZMUO, ZMUB). **Montenegro:** Recorded from the former Yugoslavia [YU] in Johnson (2004), in reality being from Montenegro, Budva leg. Johnson. **Ukraine:** Krim, Evpatoria, pos. Zvozernoye 5.viii.2000 leg. I. A. Solodovnikov 5 ex (cIAS, CMS).

Actidium reticulatum Besuchet, 1971. **Italy:** Toscana (Siena), W. of Brenna, Merse riv. 30.vi.2008 leg. M. Sörensson 14 ex (cMS). **Latvia:** Mežmuiža, Rauza riv.; *vide* Vorst *et al.* (2007). **Russia [FE]:** Lazovskiy zap.; *vide* Polilov (2008).

Bambara contorta (Dybas, 1966). **Norway:** Tofte, Hurum; *vide* Hagen *et al.* (2013). **Sweden:** Karlshamn; *vide* Sörensson (2007).

Euryptilium gillmeisteri Flach, 1889. **Latvia:** Ilgas 9-12.ix.1996 leg. A. Barševskis 1 ex (cAB) (Barševskis 2001). **Sweden:** Högsrum; *vide* Sörensson (2007). **Russia [FE]:** okr. Lazo; *vide* Polilov (2008).

Euryptilium saxonicum (Gillmeister, 1845). **Albania:** Kruja leg. Mader 1 male (coll. unknown). **Latvia:** *vide* Telnov *et al.* (2010). **Slovakia:** Tisovec-Šarkanica, Vyžkum pro NP Múránska planina 17.v.2003 leg. M. Mantič 1 ex (cMM) (Nakládal *et al.* 2008).

Micridium halidaii (Matthews, 1868). **Latvia:** Ilgas 6.vi.1999 leg. A. Barševskis 1 ex (cAB) (Barševskis 2001).

Micridium vittatum (Motschulsky, 1845). **Russia [ST]:** Guzeripl; *vide* Polilov & Bibin (2004).

Oligella foveolata (Allibert, 1844). **Hungary:** Balatonakali vi.1987 leg. M. Sieber 5 ex (cMSb) (cMS). **Latvia:** Šķeltiņi; *vide* Barševskis (2001). **Spain:** Albarracín, Ternel 22.v.1982 leg. J. Berzosa 1 ex "hojarasca de *Juniperus thuriphera*" (cRO).

Oligella intermedia Besuchet, 1971. **The Netherlands:** Renkum 1924; *vide* Vorst (2007b).

Oligella nana (A. Strand, 1946). **Hungary:** Tahitótfalu, Pánkúti rét. 2.viii.1961 leg. A. Sundholm 1 ex (ZMUL). **Poland:** Maldyty 7.iii.2006 leg. R. Gawroński 1 ex (cRG).

Ptiliola brevicollis (Matthews, 1860). **Czech Republic:** Moravia. bor., Šilheřovice Park 5.xii.2004 leg. M. Mantič 2 ex (cMM, CMS). **Latvia:** Šķeltiņi; *vide* Barševskis (2001). **The Netherlands:** Overschild, Schildmeer; *vide* Vorst (2007a).

Ptiliola kunzei (Heer, 1841). **Greece:** Vironia, Beles (Kerkini) mts., Wetland Kerkini 17-18. vi.2008 leg. G. Ramel 1 ex (cMS). **Russia [FE]:** Sakhalin (SW), 20 km N. Kholansk, Pionery 21-26.vi.1993 10 ex leg. A. N. Nilsson (cANN).

Ptiliolium caledonicum (Sharp, 1871). **Turkey:** Antalya, N. of Yarpuz 20.vi.2006 leg. S. Lundberg 1 ex (cSL).

Ptiliolium schwarzii (Flach, 1887). **Czech Republic:** Bohem., Králický Sněžník, Uhliško 10.ix.2004 leg. M. Boukal 3 ex (cMB). **Greece:** Neo Pretitsi vill., Sultanitsa 23-29. vi.2008 leg. G. Ramel 1 ex (cMS). **Switzerland:** Schwanden 17.vii.1992 leg. M. Sieber 1 ex (cMSb).

Ptiliolium wuesthoffii Rosskothen, 1934. **The Netherlands:** Westelbeers; *vide* Vorst (2007b).

Ptiliolium africanum Peyerimhoff, 1917. **Portugal:** Bragança distr., Mogadouro, Bruçó, PNDI Nat. Res. 21.ii.2001 leg. I. Silva 3 ex (cIS, cMS). **Cyprus:** Trodos-mts, Moumouros, Argakitis Agias, S. Stavros 30.iii.1999 leg. M. Weidlich 4 ex (cAP, cMS).

Ptiliolium fuscum (Erichson, 1845). **Albania:** Kruja leg. Mader 1 ex (coll.?). **Belarus:** d. Pridvinie, VSSR 13 km z. Vitebska 1.vii.1995 leg. I. A. Solodovnikov 1 ex (cIAS).

Portugal: mer. reg. Faro, Nave 5.iii.2004 leg. M. Mantič 1 ex (cMM). **Slovenia:** Umgebung Marburg [Maribor] Styria med. 2 ex (ZMUH). **Russia [FE]:** Dolina r. Kema; *vide* Polilov (2008).

Ptiliolium hopffgartenii (Flach, 1888). **Greece:** Vironia, Beles (Kerkini) mts., Kerkini wetlands 18.vi.2008 leg. G. Ramel 1 ex (cMS).

Ptiliolium marginatum (Aubé, 1850). **Montenegro:** recorded from the former Yugoslavia in Johnson (2004), in reality being from Montenegro, Majstori leg. Johnson (Johnson 2003). **Russia [FE]:** Lazovskiy zap.; *vide* Polilov (2008).

Ptiliolium sahlbergii (Flach, 1888). **Latvia:** *vide* Telnov (2001). **Slovakia:** The record for Slovakia is erroneous and should be deleted. **Russia [FE]:** Lazovskiy zap.; *vide* Polilov (2008).

Typhloptilium oedipus (Flach, 1886). **Armenia:** Armen. Geb. leg. Leder & Reitter 1 ex (DEIE). **Croatia:** Krivosije leg. Paganetti 16 ex (DEIE, ZMUO, cMS). **Montenegro:** Radostak 1907 leg. Moczarski 2 ex (coll.?). **Serbia:** recorded from the former Yugoslavia in Johnson (2004), in reality being from Serbia, Stol Planina (MHNG) (Johnson 2003). **Slovenia:** Mt. Maggiore v.1912 1 ex (DEIE); Carniola, Nanos 1 ex (DEIE).

Typhloptilium reitteri (Flach, 1887). **Azerbaijan:** recorded from “Caucasus” in Johnson (2004), in reality being from Azerbaijan (Sörensson pers. obs.).

Ptilium affine Erichson, 1845. **Italy:** recorded for Italy from various provinces (Horion 1949; Poggi 1995) though not mentioned by Besuchet (1971, 1976), thereby indicating doubt as to its presence; *vide* chapter 4.1 for discussion. **The Netherlands:** the record in Besuchet (1976) cannot be verified; *vide* chapter 4.2 above and Vorst (2010). **Russia [NT]:** the presence in North West Russia (Karelia) is unlikely; *vide* chapter 4.1 for discussion.

Ptilium caesum Erichson, 1845. **Italy:** recorded for Italy from various provinces (Horion 1949; Poggi 1995) though not mentioned by Besuchet (1971, 1976), thereby indicating doubt as to its presence; *vide* chapter 4.1 for discussion.

Ptilium exaratum (Allibert, 1844). **Latvia:** Šķeltiņi; *vide* Barševskis (2001). **The Netherlands:** Winterswijk; *vide* Vorst (2007b). **Romania:** Varhagy, Transsylv. 1 ex (ZMUB).

Ptilium horioni Rosskothen, 1934. **Hungary:** Villány/Siklos v.1985 leg. M. Sieber 1 ex (cMSb). **The Netherlands:** Ommen; *vide* Vorst (2007b). **Slovakia:** Krivoklát-Drienová mt. 27.x.2003 leg. M. Mantič 5 ex (cMM, cMS) (Nakládal *et al.* 2008).

Ptilium modestum Wankowicz, 1869. **Latvia:** *vide* Telnov (2008). **The Netherlands:** De Imbosch; *vide* Vorst (2007b).

Ptilium myrmecophilum (Allibert, 1844). **Bulgaria:** Vitosha mtns., Bistrica distr. 1000m 15.x.1995 1 ex (cAL); *vide* Lapeva-Gjonova (2013). **The Netherlands:** *vide* catalogue in Vorst (2010).

Ptilium tenue Kraatz, 1858. **Hungary:** Baranya m., Totszentgyörgy 27.iv.2004 leg. O. Merkl & A. Grabant 2 ex (NHMB, cMS).

Ptilium timidum Besuchet, 1971. **The Netherlands:** Sittard; *vide* Vorst (2007b).

Skidmorella magnifica Johnson, 1971. **Japan:** Shikoku; *vide* Sawada & Hirowatari (2003). This is the first record from the Palaearctic region.

Microptilium palustre Kuntzen, 1914. **Sweden:** Torslunda; *vide* Sörensson (2007).

Microptilium pulchellum (Allibert, 1844). **Germany:** Sachsen, Umgeb. Grosschönau, Kr. Zittau 27.vii.1995 leg. M. Sieber 1 ex (cMSb) (Sieber & Klausnitzer 2005).

Pteryx splendens A. Strand, 1960. **Germany:** Kr. Pinneberg; *vide* Hansmann (2009). **Slovakia:** Nižny Komárnik 8.vii.2002 leg. M. Mantič 1 ex (cMM).

Pteryx suturalis (Heer, 1841). **Croatia:** Crni-Lug, 12 km W. of Delnice 24.vii.2000 leg. M. Mantič 1 ex (cMM); Krivosije leg. Paganetti 2 ex (ZMUC). **Russia [FE]:** Khabarovsk reg., Verkhnebureyinsky distr., Bureyinsky N.R. 28.vii.2006 leg. Y. Marusik 4 ex (cYM, cMS).

Ptinella aptera (Guérin-Méneville, 1839). **Bulgaria:** Albena 14.vi.1984 leg. T. Palm 17 ex (ZMUL). **The Netherlands:** common; *vide* Vorst (2010). **Portugal:** mer. reg. Faro, Nave 5.iii.2004 leg. M. Mantič 9 ex (cMM, cMS). **Russia [ST]:** Guzeripl; *vide* Polilov & Bibin (2004).

Ptinella britannica Matthews, 1858. **Sweden:** Genarp; *vide* Sörensson (2007).

Ptinella cavelli (Broun, 1893). **Norway:** Tofte, Hurum; *vide* Hagen *et al.* (2013).

Ptinella denticollis (Fairmaire, 1858). **Belgium:** *vide* Cuppen & Vorst (2002). **The Netherlands:** den Haag; *vide* Vorst (2007b). **Norway:** Rollag, Veggli 23.vi.1995 leg. B. Sagvolden 1 ex (cBS).

Ptinella errabunda Johnson, 1975. **France:** Essone, Les Molières, ix.2013 leg. P. Reisdorf, 2 ex (cPR, cMS); cfr. Sörensson (2014). **Luxembourg:** Enneschte Bësch; *vide* Köhler (2011).

Ptinella johnsoni Rutanen, 1985. **Norway:** Rollag, Veggli 20.viii.1996 leg. B. Sagvolden 1 ex (cBS).

Ptinella limbata (Heer, 1841). **Croatia:** Crni-Lug, 12 km W. of Delnice 24.vii.2000 leg. M. Mantič 1 ex (cMM). **Latvia:** *vide* Telnov *et al.* (2008). **Luxembourg:** Enneschte Bësch; *vide* Köhler (2011). **Russia [NT]:** Karelia, 8 km N. Gumbaritsa at riv. Swir 31.vii.1994 leg. M. Sörensson 6 ex (cMS). **Russia [ST]:** Guzeripl; *vide* Polilov & Bibin (2004). **Russia [FE]:** okr. Kanala; *vide* Polilov (2008).

Ptinella microscopica (Gillmeister, 1845). **Hungary**: Balatongyörök v.1995 leg. M. Sieber 8 ex (cMSb, cMS). **Russia [FE]**: Lazovskiy zap.; *vide* Polilov (2008). *Ptinella populicola* Vorst, 2012. Recently described from The Netherlands (Vorst 2012). Also recorded from USA: Maryland [NAR].

Ptinella tenella (Erichson, 1845). **Denmark**: Lyng Huse; *vide* Hansen *et al.* (2000). **Estonia**: recorded mistakenly from Estonia in Silfverberg (2010); *vide* Telnov *et al.* (2007). **Italy**: recorded for Italy from various provinces (Horion 1949; Luigioni 1929; Poggi 1995) though not mentioned by Besuchet (1971, 1976). Old records need confirmation. **Latvia**: Rīga; *vide* Telnov *et al.* (2007). **Lithuania**: recorded mistakenly from Lithuania in Silfverberg (2010); *vide* Telnov *et al.* (2007).

Acrotrichis atomaria (De Geer, 1774). **Bulgaria**: Albena 24.viii.1986 leg. T.-E. Leiler 12 ex (MNHS). **Croatia**: Klst, Kokos, Dobrutscha leg. Breit 11 ex (NISK). **Slovenia**: Nanos, Carn. leg. Winkler 1 ex (MCNG). **Russia [ST]**: Guzeripl; *vide* Polilov & Bibin (2004). *Acrotrichis brevipennis* (Erichson, 1845). **Spain**: Mallorca 5-22.ix.1953 leg. G. Benick 3 ex (MHNG).

Acrotrichis cognata (Matthews, 1877). **Czech Republic**: Boh. mer. Šumava mts, Boubin 17.viii.2004 leg. O. Nakládal & J. Farkač 1 ex (cON); *vide* Nakládal & Sörensson (2008). **Estonia**: catalogue record; *vide* Silfverberg (2010).

Acrotrichis danica Sundt, 1958. **Czech Republic**: Morav. bor. Jeseníky-Praděd mtn. 28.ix.2000 leg. M. Mantič 1 ex (cMM); *vide* Nakládal & Sörensson (2008). **Romania**: Herkulesbad 21.v.1931 1 ex (MHUB).

Acrotrichis dispar (Matthews, 1865). **Czech Republic**: Moravia bor., Opava env.; *vide* Nakládal & Sörensson (2008). **Latvia**: Valka d., Mežole PNT; *vide* Telnov *et al.* (2007). **Slovakia**: Tisovec-Šarkanica, Vyžkum pro NP Múránska planina 17.v.2003 leg. M. Mantič 3 ex (cMM, cMS). **Spain**: prov. Gipuzkoa; *vide* Vorst (2013). **Russia [ST]**: Guzeripl; *vide* Polilov & Bibin (2004). **Russia [FE]**: Sakhalin (SW), 20 km N. Kholansk, Pionery 21-26.vi.1993 1 ex leg. A. N. Nilsson (cANN). **China**: Sichuan [SCH]: Szechuan (mittel-), Hwa-yin-sham 1600m leg. Reitter 1 ex (NISK).

Acrotrichis fascicularis (Herbst, 1793). **Bulgaria**: Umgeb. Sozopol 16.viii.1971 leg. M. Uhlig 1 ex (MHUB). **Belarus**: Verkhnyadzvinsk r-n Sz ber. oz. Osraya 1-4.vi.1995 leg. I. A. Solodovnikov 1 ex (cIAS). **Croatia**: Istria, Portoroz 13.vi-17.vii.1959 leg. T. Palm 1 ex (ZMUL). **Russia [ST]**: env. cord. Umpyr; *vide* Polilov & Bibin (2004). **Canary Islands**: Gran Canaria, Las Palomas 7.v.1968 leg. G. Benick 1 ex (MHNG). **Russia [FE]**: Dolina r. Kema; *vide* Polilov (2008). **Tadzhikistan**: Turkestan, Ghissar Mts. 1898 leg. F. Hauser. 6 ex (MCNG).

Acrotrichis flachi (Reitter, 1891). **Syria**: Jabal an Nusuyriyah, Slunfeh env. 17.iv.2008 leg. P. Hlavač 48 ex (cPH, cMS). **Turkey**: Bolu, strada per Abant, 1000m, 17.vii.1987 leg. G. Gardini (MCNG).

Acrotrichis henrici (Matthews, 1872). **Sweden**: Motala; *vide* Sörensson (2007).

Acrotrichis insularis (Mäklin, 1852). **Austria**: *vide* Kapp (1998). **Czech Republic**: Morav. bor. Jeseníky-Praděd mtn. 28.ix.2000 leg. M. Mantič 1 ex (cMM); *vide* Nakládal & Sörensson (2008). **Estonia**: recorded mistakenly from Estonia in Silfverberg (2010); *vide* Telnov *et al.* (2007). **Latvia**: Gulgene d.; *vide* Telnov *et al.* (2007). **Lithuania**: recorded mistakenly from Lithuania in Silfverberg (2010); *vide* Telnov *et al.* (2007).

Acrotrichis intermedia (Gillmeister, 1845). **Croatia:** Crni-Lug, 12 km W. of Delnice 24.vii.2000 leg. M. Mantič 6 ex (cMM, cMS). **Greece:** Vironia, Ramna, 16-22. vi.2008 750m leg. G. Ramel 1 ex (cGR). **Russia [FE]:** Maritime prov., Vladivostok, Akademgorod Forest Park 30.ix.1997 leg. Y. Marusik 13 ex (cYM, cMS).

Acrotrichis lucidula Rosskothen, 1935. **Slovakia:** Mníčhova Lehota 26.x.2003 leg. M. Mantič 1 ex (cMM); *vide* Nakládal *et al.* (2008).

Acrotrichis meridiana Sawada et Hirowatari, 2002. **Russia [FE]:** okr. Kanala; *vide* Polilov (2008).

Acrotrichis montandonii (Allibert, 1844). **Bulgaria:** Albena 1.ix.1983 leg. T. Palm 2 ex (ZMUL). **Croatia:** Slavonien, Brod 10.vii-14.vii.1956 leg. T. Palm 2 ex (ZMUL). **Russia [ST]:** Krasnodar, Kr. Ublinskaya 19-21.v.1972 leg. N. B. Nikitsky 1 ex (ZMLM).

Acrotrichis nana A. Strand, 1946. **Denmark:** Tofte Skov; *vide* Sörensson (2007). **Finland:** Pertunmaa; *vide* Sörensson (2007). **Germany:** Bleiberg, Saale; *vide* Sörensson (2007). **Luxembourg:** Enneschte Bësch; *vide* Köhler (2011). **Poland:** Pojezierze Mazurskie; *vide* Sörensson (2007). **Sweden:** Ängelholm; *vide* Sörensson (2007).

Acrotrichis norvegica A. Strand, 1941. **Belarus:** 3 km z. Vitebska 12.iii.1997 leg. I. A. Solodovnikov 1 ex (cIAS).

Acrotrichis parva Rosskothen, 1935. **Czech Republic:** Bohem., Králický Sněžník, Uhliško 10.ix.2004 leg. M. Boukal 11 ex (cMB). **France:** Alsace; *vide* Callot (2001). **Latvia:** Ilgas 18.vi.1997 leg. A. Barševskis 1 ex (cAB); *vide* Barševskis (2001). **The Netherlands:** Anderen, Eexterveld; *vide* Vorst (2007b). **Slovenia:** Nanos, Carn. leg. Winkler 1 ex (MCNG). **Russia [ES]:** Quell-Gebiet des Irkut leg. Leder 1 ex (DEIE). **Mongolia:** Central aimak 126 km N Ulan-Bator 1100m 9.vii.1964 leg. Z. Kaszab 1 ex (NISK).

Acrotrichis pumila (Erichson, 1845). **Belarus:** Verkhnyadzvinsk r-n Sz ber. oz. Osraya 1-4.vi.1995 leg. I. A. Solodovnikov 1 ex (cIAS). **Greece:** Neo Petrisi, Farfara, wetland Kerkini 30.iv-4.v.2008 750m leg. G. Ramel 1 ex (cGR). **Hungary:** Balatongyörök v.1995 leg. M. Sieber 2 ex (cMSb, cMS). **Japan:** Nagasaki; *vide* Sawada & Hirowatari (2002a).

Acrotrichis rosskotheni Sundt, 1971. **Latvia:** Rīga; *vide* Telnov *et al.* (2007). **Montenegro:** Bocche di Cataro [ex coll. Reitter] 2 ex (NISK); see also Johnson (1975). **Romania:** Herkulesbad 21.v.1931 1 ex (MHUB). **Slovakia:** S. of Bratislava leg. R. Dvorak 1 ex (NISK); Slátila nad Bebravou 29.x.1999 leg. M. Mantič 1 ex (cMM); *vide* Nakládal *et al.* (2008). **Russia [ST]:** Daghestan leg. Leder & Reitter 4 ex (DEIE, NISK, cMS); Tshekhn-Ingushetya, Assa valley, 9 km SSW Muzhikhi 800 m 15.vii.1986 leg. Golovatch 1 ex (SMNS).

Acrotrichis rugulosa Rosskothen, 1935. **Belarus:** d. Poddubye, 16 km v Vitebska 17.vii.2001 leg. Smolyakov 1 ex (cIAS). **Czech Republic:** Boh. mer. Šumava mts, Boubin 17.viii.2004 leg. O. Nakládal & J. Farkač 15 ex (cON, cMS); *vide* Nakládal & Sörensson (2008). **Latvia:** *vide* Telnov *et al.* (2008). **Slovakia:** Tisovec-Šarkanica, Výzkum pro NP Múránska planina 17.v.2003 leg. M. Mantič 11 ex (cMM, cMS); *vide* Nakládal *et al.* (2008). **Spain:** prov. Gipuzkoa; *vide* Vorst (2013). **Russia [FE]:** okr. Starka; *vide* Polilov (2008).

Acrotrichis ryukyuensis Sawada et Hirowatari, 2002. **Russia [FE]:** Lazovskiy zap.; *vide* Polilov (2008).

Acrotrichis sericans (Heer, 1841). **Lithuania:** *vide* Tamutis & Ferenca (2006). **Montenegro:** Recorded from the former Yugoslavia [YU] in Johnson (2004), in reality being from Montenegro, Radoštak (Johnson 2003:65). **Russia [FE]:** okr. Kanala; *vide* Polilov (2008).

Acrotrichis silvatica Rosskothen, 1935. **Croatia:** Krivosije leg. Paganetti 1 ex (cMS). **Czech Republic:** Moravia bor., Šilheřovice-Černý les 8.ix.2002 leg. M. Mantič 4 ex (cMM, cMS); *vide* Nakládal & Sörensson (2008). **France:** Alsace; *vide* Callot (2001). **Latvia:** *vide* Telnov *et al.* (2010). **Slovakia:** Tisovec-Šarkanica, Vyžkum pro NP Múránska planina 17.v.2003 leg. M. Mantič 1 ex (cMM); *vide* Nakládal *et al.* (2008). **Russia [ES]:** Irkutsk, Schelikhov 15.viii.1968 leg. T.-E. Leiler 1 ex (MNHS). **Russia [FE]:** Khabarovsk reg., Verkhnebureyinsky distr., Bureyinsky N.R. 28.vii.2006 leg. Y. Marusik 5 ex (cYM, cMS).

Acrotrichis sitkaensis (Motschulsky, 1845). **Belarus:** Verkhnyadzvinsk r-n, Sz. ber. oz. Osraya 1-4.vi.1995 leg. I. A. Solodovnikov 27 ex (cIAS, cMS). **Czech Republic:** Bohemia, Zahradky 24.iii.1978 leg. M. Sieber 1 ex (cMSb). **Italy:** Tirol, Riva 1898 leg. Münster 1 ex (cMS). **Lithuania:** *vide* Tamutis & Ferenca (2006). **Montenegro:** Bocche di Cataro (ex coll. Reitter) 2 ex (NISK). **Slovakia:** Svátý Jur 14.iii.2003 7 ex (cMM, cMS); *vide* Nakládal *et al.* (2008). **Ukraine:** Krim, s. Perevalnoye 8.vii.1997 leg. I.A. Solodovnikov 8 ex (cIAS, cMS). **Russia [FE]:** okr. Starka; *vide* Polilov (2008).

Acrotrichis sjobergi Sundt, 1958. **Russia [FE]:** Khabarovsk-Prov. Bolshe Khekhtsyrsky Res. 4-450m 6-10.vi.1990 leg. W. Schawaller 2 ex (SMNS); Maritime prov., Vladivostok, Akademgorod Forest Park 30.ix.1997 leg. Y. Marusik 4 ex (cYM, cMS); Khabarovsk reg., Verkhnebureyinsky distr., Bureyinsky N.R. 28.vii.2006 leg. Y. Marusik 29 ex (cYM, cMS).

Acrotrichis soror (Flach, 1889). **Armenia:** Armen Geb. leg. Leder & Reitter 3 ex (DEIE, NISK, cMS). **Russia [ST]:** Kavkaz leg. Dr. Vesely 4 ex (NISK, cMS); Sotchi, upper reaches of r. Agura, 16-28.vi.1999 leg. I. A. Solodovnikov 1 ex (cIAS).

Acrotrichis strandi Sundt, 1958. **Belarus:** 3 km juz Vitebska 30.iv.1995 leg. I. A. Solodovnikov 20 ex (cIAS) (cMS). **Estonia:** recorded mistakenly from Estonia in Silfverberg (2010); *vide* Telnov *et al.* (2007). **Latvia:** *vide* catalogue; Telnov (2004). **Lithuania:** add Lithuania [LT]; *vide* Ivinskis *et al.* (2009). **Russia [FE]:** Maritime prov., Lake Khanka 15-16.vii.1998 leg. Y. Marusik 1 ex (cMS).

Acrotrichis suecica Sundt, 1958. **Belarus:** d. Butyazhi, 16 km jujuz Vitebska 23.vi.1998 leg. I. Bashkirov 14 ex (cIAS, cMS).

Acrotrichis thoracica (Waltl, 1838). **Bulgaria:** Albena 28.vi.1985 leg. S. Lundberg 1 ex (cSL). **Croatia:** Velebit leg. R. Mensel 13 ex (MHUB, cMS). **Estonia:** Matsalu 15.ix.1991 leg. N. Linnman 1 ex (MNHS). **Russia [FE]:** Primorskiy kraj, Vladivostok 11.vii.1993 leg. A. Pütz 1 ex (cAP). **China: Sichuan [SCH]:** Szechuan, W. Wassuland Bzk Sangkiangkou 1600m 20.x.1934 leg. H. Becker 7 ex (NISK).

Acrotrichis volans (Motschulsky, 1845). **Germany:** recorded with doubt from Schleswig-Holstein (Meybohm 2001); see discussion above. **Russia [FE]:** NE Siberia, near Talan, 150 km NW Magadan 21-23.viii.1990 leg. Y. Marusik 9 ex (SMNS, cMS); Khabarovsk reg., Verkhnebureyinsky distr., Bureyinsky N.R. 28.vii.2006 leg. Y. Marusik 27 ex (cYM, cMS).

Acrotrichis williamsi Johnson, 2007. **Portugal:** mer. reg. Faro, Nave 5.iii.2004 leg. M. Mantič 109 ex (cMM, cMS).

Acrotrichis grandicollis (Mannerheim, 1844). **Azerbaijan:** Helenendorf [Göygöl] leg. Reitter 2 ex (NISK). **Bosnia Herzegovina:** Central Bosnien leg. Reitter 1 ex (NISK).

Montenegro: Recorded from former Yugoslavia [YU] in Johnson (2004), in reality being from Montenegro, Radoštak (Johnson 2003:65). **Norway:** this well established species was accidentally omitted for Norway [NR] in Johnson (2004). **Russia [FE]:** Sakhalin (SW), 20 km N. Kholansk, Pionery 21-26.vi.1993 3 ex leg. Anders N. Nilsson (cANN); Marit. prov., Uglovaya village 4.x.1997 leg. Y. Marusik 7 ex (cMS). **China: Sichuan [SCH]:** Szechuan (mittel-), Hwa-yin-sham 1600m leg. Reitter 1 ex (NISK). **Kazakhstan [A:KZ]:** Tschu river leg. J. Sahlberg. “1504” 1 ex (ZMUH). **Tadzhikistan:** Turkestan, Ghissar Mts. 1898 leg. F. Hauser. 1 ex (MCNG).

Acrotrichis sanctaeheleneae Johnson, 1972. **Denmark:** Sorø; *vide* Pedersen *et al.* (2010).

Italy: *vide* de Marzo (2002). **Germany:** *vide* Gollkowski (2008). **The Netherlands:** Ter Apel; *vide* Vorst (2007). **Sweden:** Slottsskogen; *vide* Sörensson (2007).

Acrotrichis kubotai Sundt, 1969. **Russia [FE]:** Lazovskiy zap.; *vide* Polilov (2008).

Acrotrichis lewisii (Matthews, 1884). **Russia [FE]:** Sakhalin, Kirilov 20.xi.1988 leg. G. Basarukin 1 ex (cAP). **China: Sichuan [SCH]:** Szechuan, Niton Tatsieniu leg. Reitter 1 ex (NISK); Szechuan, W. Wassuland Bzk Sankingkou x-xi.1934 leg. H. Becker 10 ex “Mischwald, bei Ameisen” (NISK).

Acrotrichis similaris Sundt, 1969. **Russia [FE]:** Lazovskiy zap.; *vide* Polilov (2008).

Actinopteryx fucicola (Allibert, 1844). **Bosnia Herzegovina:** Sutorine leg. Paganetti 2 ex (ZMUO). **Croatia:** Split 20.vi.1956 leg. T.-E. Leiler 1 ex (MNHS); Petrcane, 6 km NW of Zadar 16-21.vii.2000 leg. M. Mantič 3 ex (cMM, cMS). **Montenegro:** Budva; *vide* Novak (1952:74).

Actinopteryx parallela Britten, 1926. **Russia [FE]:** okr. d. Rjyzanovka.; *vide* Polilov (2008).

Baeocrara japonica (Matthews, 1884). **Belarus:** okr. Vitebska 18.viii.1996 leg. I. A. Solodovnikov 5 ex (cIAS, cMS). **Latvia:** Dunava 13.viii.1996 leg. A. Barševskis 1 ex (cAB); *vide* Barševskis (2001). **Slovakia:** Opatovce 27.x.2002 leg. M. Mantič 3 ex (cMM, cMS); *vide* Nakládal *et al.* (2008). **Russia [FE]:** okr. Kanala.; *vide* Polilov (2008).

Baeocrara variolosa (Mulsant et Rey, 1861). **Latvia:** *vide* Telnov *et al.* (2010). **Lithuania:** *vide* catalogue (Tamatit *et al.* 2011). **Slovakia:** Tisovec-Sarkanica, Vyžkum pro NP Múránska planina 17.v.2003 leg. M. Mantič 1 ex (cMM); *vide* Nakládal *et al.* (2008). **Spain:** prov. Gipuzkoa; *vide* Vorst (2013). **Russia [FE]:** Sakhalin, Kirilov 20.xi.1988 leg. G. Basarukin 1 ex (cAP).

Smicrus filicornis (Fairmeire et Laboulbène, 1855). **Latvia:** Šķeltiņi 1.viii.1995 leg. A. Barševskis 1 ex (cAB); *vide* Barševskis (2001). **Portugal:** *vide* De F. e Silva *et al.* (2009).

4.4. Distribution patterns and trends

The division in geographical entities (symbols) of the Catalogue of Palaearctic Coleoptera (Löbl & Smetana 2004; Löbl & Löbl 2015) rests on political, administrative and

biogeographical boundaries and includes the continents of Europe, North Africa (north of Sahara) and Asia (excluding parts which arbitrarily are defined as belonging to the Oriental region). Geographical two-letter symbols usually refer to countries, or - in some cases - to arbitrarily subdivided parts of countries (Russia, Turkey, Egypt, Kazakhstan), to island archipelagos (Canary Islands, Madeira, the Azores), to provinces (northern India, China) or to two or more countries encapsulated within a single country (e.g. San Marino included in "Italy", Monaco in "France"). In all, Europe comprises 52 such symbols, North Africa 7 symbols, while Asia comprises 38 geographical symbols of which 27 represent countries, 11 provinces or parts of countries (excluding Chinese provinces), thus, making up a total of 97 geographical two-letter symbol entities (here referred to as GE's) for the Palaearctic realm [PAL]. The 34 Chinese provinces are represented by three-letter symbols.

Europe includes, besides the mainland eastwards reaching the Ural mountains, also the Azores, most Mediterranean islands (except for Cyprus), the small part of Turkey west of the Bosphorus and the Caucasian republics of Georgia, Armenia and Azerbaijan. Russia is subdivided into six large subregions transecting over Europe and Asia (Europe: North, Central and South Territories; Asia: West Siberia, East Siberia and the Far East). In the new Catalogue edition, former Yugoslavia [YU] is being replaced by Serbia [SB], Montenegro [ME] and Kosovo [KO]. North Africa includes, besides the mainland, also the Madeira archipelago and the Canary Islands. Asia encompasses Turkey east of the Bosphorus, the Middle East, the Sinai part of Egypt, the Arabian Peninsula incl. Socotra island, Central Asia, Russia east of the Urals, Pakistan, five provinces of northern India, Bhutan, Nepal, China, Taiwan, the Korean Peninsula and Japan (incl. the Ryukyus and Pacific islands). China is subdivided into seven subregions and 34 provinces. For more information on geographical division, see Löbl & Smetana (2004) and Löbl & Löbl (2015)

The new catalogue edition of Palaearctic Ptiliidae lists 215 species in 34 genera and includes altogether 2097 geographical symbol records (see above), 84.2% (1766) of which refer to Europe as defined above, 10.2% (213) to Asia and 5.6% (118) to North Africa (Table 1). These biased figures are considered to reflect the old collecting tradition in favour of Europe rather than differences related to biodiversity and biogeography; cfr. Fig. 1. Surely, many more species are expected to be discovered in the southern and eastern parts of the Palaearctic in the future, as opposed to the 'saturated' condition of North and Central Europe where few new species await detection. In these areas, when taking the last 200 years of collecting efforts into consideration, the current faunistic coverage is estimated to amount to 75-95% of the expected 'absolute' number of species. In other areas, these figures are less, or much less. Figure 1 depicts the current standing (1st of January 2015) of ptiliid species numbers per country/geographical symbol (GE). It highlights the highly skewed collecting efforts through time between Europe and the rest of the Palaearctic realm. Today, very small geographical entities like Denmark and The Netherlands, both constituting around 0.1% of the total Palaearctic land mass, outnumbers vast regions like Turkey (2% of the total Palaearctic land mass) and China (30%). Without doubt, these differences will be reversed by time.

From a total of 215 species, 166 species (78%) may be considered as strictly Palaearctic, i.e. not occurring outside the Palaearctic realm. The remaining 49 species (22%) are thus

being distributed in one or several other realms outside (Table 5). Among them the Nearctic realm dominates, with more shared species distributions than any other realm (32 species). The Palaearctic ptiliid fauna, thus, seems to have its strongest affinities to the North American fauna and a Holarctic distribution is obviously the dominating pattern among Palaearctic Ptiliidae with extra-Palaearctic distributions. From 32 Holarctic ptiliid species, 20 may be regarded as 'true' Holoarctics, i.e. only occurring in the Palaearctic and the Nearctic realm. A few of them probably represent species taxa of old Holarctic distribution patterns, i.e. being the result of pre- or postglacial migration processes (e.g. *Acrotrichis intermedia* (Gillmeister) and *A. volans* (Motschulsky)) while others obviously are more or less modern, being at least partly the result of recent migration processes caused by man's activities (*Oligella foveolata* (Allibert), *Millidium minutissimum* (Weber et Mohr) and *Acrotrichis thoracica* (Waltl). Especially species predominantly found in compost heaps, old hay and stable manure belong to this latter group.

The seven most species-rich genera of the Palaearctic realm are given in Table 3. Not surprisingly, the most species-rich ptiliid genus of the globe, *Acrotrichis* Motschulsky, takes a lead (52 species), followed by *Ptenidium* Erichson (32) and *Ptilolum* Flach (18). There is a distinct variation in top seven genus ranking between Europe, North Africa and Asia, as exemplified by the mainly western Palaearctic genus *Ptilium* Gyllenhal (species of 'Ptilium' described from other parts of the world may, at least partly, belong to other genera (*Ptilolum* Flach, *Gomyella* Johnson, etc)), although *Acrotrichis* maintains its leading position in all three continents. In North Africa, the genera *Ptenidium* and *Actidium* Matthews own a distinctly larger proportion of the total species stock than in other Palaearctic continents while genus *Cissidum* Motschulsky is third ranked in Asia. An interesting observation is the narrow variation of these seven top genera as to percentage of the total species stock between individual continents, ranging between 73% and 81%. If these figures also hold for other realms (and when more species are added in future) roughly three fourths or four fifths of the total species stock are made up of the seven most species-rich genera.

Species-poor genera (14), containing only a single species in the Palaearctic realm, make up 41% of the total number (34) of Palaearctic genera but only 6.5% of the corresponding species stock. Seven species-poor genera are globally monotypic. This genus-species difference indicates (1) a comparatively high incidence of species-poor genera in general, and (2) a heterogeneous assemblage of phylogenetic 'end-leaf' taxa in particular.

As for Palaearctic 'continental genus endemics', i.e. genera (globally) having their predominant distribution centers in one single Palaearctic continent (Europe, North Africa or Asia), or part of continent, especially oligospecific genera of the tribe Nanosellini stand out. Also, species-poor genera like *Microptilium* Matthews and *Astatopteryx* Perris qualify in this category.

In Europe, a total of 139 species have been recorded (Table 1), many belonging to the temperate forest eco-systems. In part, the lack of tree vegetation explains the comparative poverty of the ptiliid fauna of North Africa (54 species), where significant forest systems of this kind are wanting. In fact, only one single genus (of 34) - *Actidium* Matthews - holds more species in North Africa (and Asia) than in Europe (Table 3), certainly the effect of a unique evolutionary adaptation to a habitat (littorals) often found in open, sun-exposed environments in dry regions, where few other ptiliids thrive. The 117 species recorded so far

in Asia is presumed to be only a fraction of the real number; cfr. Fig. 1. A large number of species are 'unique' for any Palaearctic continent (Table 1), e.g. Europe (50 unique species) and Asia (51), possibly reflecting recent (on-going) phyletic radiation (species swarms), or ecological specialization and adaptation to old, stable biomes/habitats little influenced by man. North Africa possesses several unique elements (16 species), some of them possibly endemics, like certain riparian *Actidium* species or saproxylic *Ptenidium* species.

It is noteworthy that only seven species (out of 215), occurring in all PAL-continents (Europe, North Africa, Asia), are globally unique to the Palaearctic realm. They are *Ptenidium insulare* Flach, *P. longicorne* Fuss, *Actidium coarctatum* (Haliday), *Micridium vittatum* (Motschulsky), *Microptilium pulchellum* (Allibert), *Ptinella denticollis* (Fairmaire) and *Acrotrichis rosskotheni* Sundt, practically all of them being stenoecious habitat specialists (saproxyllics, ancient wetland species or coastal littoral species). This contrasts with the further 14 species of similar Palaearctic profile which, however, also occur outside the Palaearctic realm, namely *Ptenidium nitidum* (Heer), *P. punctatum* (Gyllenhal), *P. pusillum* (Gyllenhal), *Millidium minutissimum* (Weber et Mohr), *Ptiliola kunzei* (Heer), *Ptiliolum fuscum* (Erichson), *P. spencei* (Allibert), *Ptinella aptera* (Guerin-Méneville), *Acrotrichis fascicularis* (Herbst), *A. montandonii* (Allibert), *A. sericans* (Heer), *A. thoracica* (Waltl), *A. grandicollis* (Mannerheim) and *Actinopteryx fucicola* (Allibert), the majority of which are anthropophilic elements of almost global spreading, often as a result of accidental introductions; cfr. Sörensson & Johnson (2004).

In fact, a few widely spread semi-cosmopolitan species were repeatedly discovered and named by local taxonomists (Table 4). Anthropophilic compost species like *Ptenidium pusillum* (Gyllenhal) and *Acrotrichis sericans* (Heer) were both redescribed from Australia and the New World and for long regarded as indigenous elements of those realms. Not until recently their true identities were unveiled (Johnson 2001, 2003). Table 4 provides a summary of all available names of Ptiliidae originally described from extra-Palaearctic areas. An attempt to differentiate between indigenous elements and anthropophilic elements of man-induced dispersal is being made (Table 4).

The number of ptiliid species per geographical symbol (subregion/country/province) varies considerably over the Palaearctic realm, between as well as within large regions (continents) (Table 1). In general, European symbols hold significantly more species than North African or Asian. The average ptiliid species number per geographical entity is as follows. Europe: 33.7; North Africa: 16.9; Asia: 5.6. The low number of Asia to a large extent reflects the high number of geographical entities (countries/parts of countries/provinces) lacking known records of Ptiliidae (Table 1).

Rather surprisingly, six European symbols (Andorra, Kosovo, Moldavia, Svalbard, Turkey west of Bosphorus and Kazakhstan west of the Ural river) still seem to lack records of Ptiliidae (Table 1). In North Africa, only Libya lacks records as yet. Few species, if any, are known from various countries or parts of the Arabian Peninsula. The same goes for Turkmenistan and Bhutan, and, surprisingly, also for the Korean Peninsula, all being the result of neglect rather than actual lack of species. In this respect, the species-poor ptiliid fauna of the North Atlantic islands contrasts and the lack of finds in e.g. Svalbard may actually reflect the true species number.

The most often recorded ptiliid species of the Palaearctic realm is *Acrotrichis grandicollis* (Mannerheim), with a total of 56 (out of 97 potential) GE's (Table 2). It heads also Europe (39 GE's out of 52) and Asia (12 out of 37) and is obviously widely spread in the Holarctic realm (Sörensson 2003). It is a common species in all kinds of manure and compost and was introduced in New Zealand. The next most recorded species in the Palaearctic realm are *Acrotrichis thoracica* (51 GE's), *A. sericans* (50), *A. fascicularis* (46), *Ptenidium pusillum* (46), *P. myrmicophilum* (Motschulsky) (35), *Acrotrichis atomaria* (De Geer) (35), *A. montandonii* (35), *Ptinella aptera* (34) and *Acrotrichis rosskotheni* (34). Like *A. grandicollis*, the most often recorded species are anthropophilics, often found in compost, stable manure, mouldy hay, at carcasses and in other rotting organic substances, mixed up with common forest litter species or (*P. aptera*) saproxylcs.

Similarly, in Europe, anthropophilics and compost species dominate among the next most recorded ptiliid species after *Acrotrichis grandicollis* (39), like *A. sericans* (37), *Ptenidium pusillum* (37), *Acrotrichis fascicularis* (35), *A. thoracica* (34) and *Acrotrichis montandonii* (32). Common litter species are *Acrotrichis atomaria* (34), *Ptenidium myrmicophilum* (33), *Acrotrichis intermedia* (Gillmeister) (31) and *A. rosskotheni* (30), while, surprisingly, *Ptenidium intermedium* Fuss (30) and *Pteryx suturalis* (Heer) (31) heads the ecological groups of wet-land litter species and saproxylcs, respectively (Table 2).

In North Africa and Asia this pattern is repeated, with widely spread compost-/manure-species dominating the top list of most often recorded species (Table 3). In North Africa, however, the list deviates somewhat due to presence of saproxylcs (*P. aptera* (5), *P. denticollis* Fairmaire (4)) and littoral species (*Actidium reitteri* Flach (4), *A. coarctatum* (Haliday) (3), *Actinopteryx fucicola* (4)), two of them also being continental 'endemics' (*Actidium reitteri* (4) and *Ptenidium scutellare* Guillebeau (3)). In Asia, besides the widespread anthropophilics which dominate the top list, two litter-dwelling species are found, namely two northern species of the taiga zone (*Acrotrichis sjobergi* Sundt (4) and *A. volans* (Motschulsky) (4)) and two southeastern 'endemics' (*Acrotrichis kubotai* Sundt (3) and *A. lewisii* (Matthews) (3)).

The biogeography of Ptiliidae is generally poorly known and seldom discussed in the literature. This is to some degree a consequence of real species distributions being obliterated and less obvious due to undersampling and lack of specific knowledge in many areas of the globe. Fragmented distribution patterns of widely spread ptiliid species are often due to undersampling rather than true absences in missing areas.

The combination of extremely small body size and feather-like hindwings often hypothesized species of Ptiliidae as being part of the common air plancton fauna and thus, by implication, of generally wide distributions. Although true for a few specific cases, obviously, this is far from being a general pattern. In fact, the distribution and biogeography of ptiliid taxa in general do not seem to deviate from common patterns found in other coleoptera lineages, including adaptations to climate zones and phytogeographic zones, time-dependent dispersal of introduced species, and geographical endemics. These patterns suggest that ptiliids, like other insects, dynamically respond to changes over time affecting their preferred environments, habitats and biomes. Various kinds of biogeographical patterns as shown in the list of Palaearctic Ptiliidae exemplify that (Sörensson 2015).

Most genera found in the Palaearctic realm (PAL) are shared with other realms and thus often possess transoceanic distributions in one or another direction. However, few genera actually seem to inhabit all six realms of the earth, the most prominent examples being *Actidium* Matthews, *Ptinella* Motschulsky, *Actinopteryx* Matthews and *Acrotrichis* Motschulsky. As for potential genus ‘endemism’, i.e. generic taxa that only occur in a single realm, the Palaearctic realm hosts eight candidates. Two genera, *Euryptilium* Matthews and *Microptilium* Matthews, occur in more than one continent while two others, *Baranowskella* Sörensson and *Astatopteryx* Perris, are strictly European. Four genera, *Nepalumpia* Hall, *Primorskiella* Polilov, *Sikhote lumpia* Polilov and *Ussurilumpia* Polilov, all belonging in the tribe Nanosellini, only occur in much restricted parts of Asia (Nepal and the Russian Far East). Due to severe historical undersampling knowledge about the distribution of nanoselline taxa in general is very poor. The monotypic, myrmecophilic genus *Astatopteryx* has a limited distribution through southern Europe while *Baranowskella* seems to be confined to the boreonemoral and nemoral regions of North and Central Europe. No genus ‘endemics’ are as yet known from North Africa.

Although many higher level ptiliid taxa are widely distributed, with transpalaearctic distribution or beyond, some are much restricted, perhaps reflecting old evolutionary centers, often combined with adaptive specialization and ecological ‘narrowing’ to certain habitats of comparatively stable (non-ephemeral) nature. An excellent example provides the tribe Nanosellini, ecological specialists of bracket fungi, in the Palaearctic realm with a distinct distribution center in East Asia, connecting to relatives of the American continents. This contrasts with the comparative poverty of the Central and western Palaearctic realm (*Nepalumpia* and *Baranowskella*, both monotypic). A further example provides the genus *Microptilium* Matthews, its two known extant members (*M. palustre* Kuntzen and *M. pulchellum* Allibert) showing restricted and fragmented distributions of a relict character. As *Microptilium* takes a somewhat isolated position systematically within the tribe Ptinellini its distribution pattern might mirror an evolutionary line of ancient age. This hypothesis is supported by the previous finding of a congeneric, ca 44 Myear old Baltic amber fossil species (*Microptilium geistautsi* Dybas, 1961), dated from Eocene.

The Palaearctic fauna of Ptiliidae seems to be most closely related to the Nearctic fauna, with 32 species of Holarctic distribution (15% overlap), and least affiliated with the Oriental (4%) and Neotropical (2%) fauna (Table 1). Somewhat surprising is the comparatively high overlap with the Australian fauna. This may be due to the long established intercontinental trade with timber, cattle, plants and other matters providing suitable conditions for immigrating ptiliids in either direction. High incidence of anthropophilic species occurring in stables, hay, dung, compost etc supports the hypothesis. Table 1 summarizes the extra-Palaearctic affinities while Table 3 provides a specific overview of all available species names (33) representing Palaearctic ptiliid taxa described outside of the Palaearctic and subsequently recorded from inside the realm, or found conspecific to already known Palaearctic species. It is noteworthy that anthropophilic species (favoured by activities by man) make up some 50% of the latter, a significant overrepresentation when compared to the total species number.

In principal, the current knowledge of the Palaearctic Ptiliidae distribution does not tell anything in particular about potential ptiliid diversity hot spots of the realm. This is

partly due to the still fragmentary basic knowledge of taxic diversity in the family and to the geographically highly skewed collecting efforts so far. Although the species number and distribution of the comparatively well sampled western Palaearctic fauna of Ptiliidae is surprisingly uniform, with only minor or at most modest differences between northern and southern latitudes (cfr. Fig 1), this situation cannot be extrapolated into areas outside Europe. Differences in area geology, biogeography and historical processes prevent even rough predictions of taxon richness. Only more fieldwork in previously low-sampled areas of the Palaearctic will provide a clue to better understanding of species diversity, taxic distribution and fauna relationships.

Table 1. Summary of taxon richness, distribution and intra- and extra-Palaearctic relationships of the Palaearctic [PAL] fauna of Ptiliidae, including distribution of the three subregions (continents). Numbers are based on Sörensson (2015). Numbers in square brackets define the total number of included geographical entities [GE] (countries/parts of countries/provinces). Strict SCS = single continent species, only occurring in one continent (of three) and not outside of the Palaearctic realm. *166 = occurring only in PAL; **49 = Palearctic species occurring also in other realms.

	Europe [52]	North Africa [7]	Asia [38]	PAL [97]
Number of genera:	21	14	28	34
Globally restricted genera:	2	0	4	8
Number of species:	139	54	117	215
Number of geographical symbol records [GE's]	1766 (84,2%)	118 (5,6%)	213 (10,2%)	2097
Average species number per GE:	33,7	16,9	5,6	—
Number of strict SCS's:	50	16	51	166*
SCS's occurring also in other realms:	13	0	9	49**
Highest nr of GE's for any species (max):	39 [52]	6 [7]	14 [38]	56 [97]
Number of GE's lacking known records:	6 [52]	1 [7]	12 [38]	19 [97]
Number of species shared only with Europe:	—	15 (28%)	35 (30%)	—
Number of species shared only with North Africa:	15 (10%)	—	0	—
Number of species shared only with Asia:	35 (25%)	0	—	—
Number of species shared with Nearctic realm:	31 (22%)	15 (28%)	20 (17%)	32 (15%)
Number of species shared with Neotropical realm:	4 (3%)	2 (4%)	4 (3%)	5 (2%)
Number of species shared with Afrotropical realm:	6 (4%)	5 (9%)	8 (7%)	11 (5%)
Number of species shared with Oriental realm:	1 (0,8%)	1 (2%)	9 (8%)	9 (4%)
Number of species shared with Australian realm:	14 (10%)	9 (17%)	9 (8%)	17 (8%)

Table 2. The 12 most recorded Ptiliidae in the Palaearctic realm [PAL] and per continent (Europe, North Africa, Asia) based on the number of recorded geographical entities [GE] (countries/parts of countries/provinces) per species. Species marked by '*' are restricted to a single continent within the Palaearctic realm.

	Europe [52]	North Africa [7]	Asia [38]	PAL [97]
Species 1:	<i>Acrotrichis grandicollis</i> [39]	<i>Acrotrichis sericans</i> [6]	<i>Acrotrichis grandicollis</i> [12]	<i>Acrotrichis grandicollis</i> [56]
Species 2:	<i>Acrotrichis sericans</i> [37]	<i>Acrotrichis thoracica</i> [6]	<i>Acrotrichis thoracica</i> [11]	<i>Acrotrichis thoracica</i> [51]
Species 3:	<i>Ptenidium pusillum</i> [37]	<i>Ptenidium laevigatum</i> [5]	<i>Acrotrichis sericans</i> [7]	<i>Acrotrichis sericans</i> [50]
Species 4:	<i>Acrotrichis fascicularis</i> [35]	<i>Ptenidium pusillum</i> [5]	<i>Acrotrichis fascicularis</i> [6]	<i>Acrotrichis fascicularis</i> [46]
Species 5:	<i>Acrotrichis atomaria</i> [34]	<i>Ptinella aptera</i> [5]	<i>Ptenidium pusillum</i> [4]	<i>Ptenidium pusillum</i> [46]
Species 6:	<i>Acrotrichis thoracica</i> [34]	<i>Acrotrichis fascicularis</i> [5]	<i>Acrotrichis sjobergi</i> [4]	<i>Ptenidium myrmicophilum</i> [35]
Species 7:	<i>Ptenidium myrmicophilum</i> [33]	<i>Nephanes titan</i> [5]	<i>Acrotrichis volans</i> [4]	<i>Acrotrichis atomaria</i> [35]
Species 8:	<i>Acrotrichis montandonii</i> [32]	* <i>Actidium reitteri</i> [4]	<i>Actinopteryx fucicola</i> [4]	<i>Acrotrichis montandonii</i> [35]
Species 9:	<i>Pteryx suturalis</i> [31]	<i>Ptinella denticollis</i> [4]	<i>Ptiliola kunzei</i> [3]	<i>Ptinella aptera</i> [34]
Species 10:	<i>Acrotrichis intermedia</i> [31]	<i>Actinopteryx fucicola</i> [4]	<i>Acrotrichis dispar</i> [3]	<i>Acrotrichis rosskotheni</i> [34]
Species 11:	<i>Acrotrichis rosskotheni</i> [30]	* <i>Ptenidium scutellare</i> [3]	* <i>Acrotrichis kubotai</i> [3]	<i>Pteryx suturalis</i> [33]
Species 12:	<i>Ptenidium intermedium</i> [30]	<i>Actidium coarctatum</i> [3]	* <i>Acrotrichis lewisii</i> [3]	<i>Nephanes titan</i> [33]

Table 3. The seven most species-rich genera of Ptiliidae in the Palaearctic realm [PAL]. Species numbers are shown for each continent within the Palaearctic realm. The total species numbers for the seven most species-rich genera are given, including percentage of the total species numbers for all genera.

	PAL	Europe	North Africa	Asia
<i>Acrotrichis</i> :	52	35	14	32
<i>Ptenidium</i> :	32	22	14	18
<i>Ptiliolum</i> :	18	14	6	9
<i>Ptilium</i> :	17	16	1	2
<i>Ptinella</i> :	15	13	2	7
<i>Actidium</i> :	14	6	7	7
<i>Cissidium</i> :	10	0	0	10
Total nr of species of 7 genera:	158 [73%]	106 [77%]	44 [81%]	85 [73%]
Total all species:	215	139	54	117

Table 4. Complete list of available names (valid/invalid) of species of Ptiliidae originally described from extra-Palaearctic areas, subsequently detected in the Palaearctic region, or found conspecific to well-known Palaearctic species. Species presumed indigenous (INDIG) and of natural occurrence in the Palaearctic are tentatively separated from species presumed introduced in either direction by man (ANTHRO). Order of names follows Sörensson (2015).

SPECIES NAME	ANTHRO	INDIG
<i>Kimoda globosa</i> Johnson, 1985	—	x
<i>Ptenidium rotundum</i> (Deane, 1930) [= <i>Ptenidium pusillum</i> (Gyll.)]	x	—
<i>Ptenidium tenebricosum</i> (Deane, 1932) [= <i>Ptenidium pusillum</i> (Gyll.)]	x	—
<i>Ptenidium terminale</i> (Haldeman, 1848) [= <i>Ptenidium pusillum</i> (Gyll.)]	x	—
<i>Bambara contorta</i> (Dybas, 1966)	x	—
<i>Bambara frosti</i> (Dybas, 1966)	—	x
<i>Bambara fusca</i> (Dybas, 1966)	x	—
<i>Bambara invisibilis</i> (Nietner, 1856)	—	x
<i>Skidmorella magnifica</i> Johnson, 1971	—	x
<i>Ptinella cavelli</i> (Broun, 1893)	x	—
<i>Ptinella fauvillii</i> Matthews, 1900 [= <i>P. cavelli</i> (Broun)]	x	—
<i>Ptinella simsoni</i> (Matthews, 1878)	x	—
<i>Acrotrichis cognata</i> (Matthews, 1877)	—	x
<i>Acrotrichis pruinosa</i> Hatch, 1957 [= <i>A. cognata</i> (Matthews)]	—	x
<i>Acrotrichis henrici</i> (Matthews, 1872)	x	—
<i>Acrotrichis insularis</i> (Mäklin, 1852)	x	—
<i>Acrotrichis subantarctica</i> Gr. & Sam., 1964 [= <i>A. insularis</i> (Mäklin)]	x	—
<i>Acrotrichis josephi</i> (Matthews, 1872)	x	—
<i>Acrotrichis subcognata</i> Johnson, 1975 [= <i>A. josephi</i> (Matthews)]	x	—
<i>Acrotrichis australica</i> (Deane, 1930) [= <i>A. sericans</i> (Heer)]	x	—
<i>Acrotrichis porteri</i> (Brêthes, 1915) [= <i>A. sericans</i> (Heer)]	x	—
<i>Acrotrichis setosa</i> Johnson, 1988	x	—
<i>Acrotrichis sanctaehelenae</i> Johnson, 1972	x	—
<i>Acrotrichis cursitans</i> (Nietner, 1856)	—	x
<i>Acrotrichis brunnea</i> Britten, 1926 [= <i>A. cursitans</i> (Nietner)]	—	x
<i>Acrotrichis immatura</i> (Nietner, 1856) [= <i>A. cursitans</i> (Nietner)]	—	x
<i>Actinopteryx parallela</i> Britten, 1926	—	x
<i>Actinopteryx reflexa</i> Britten, 1926	—	x
<i>Actinopteryx acuminata</i> Britten, 1926 [= <i>A. reflexa</i> Britten]	—	x
<i>Baeocrara parvula</i> Johnson, 1986	—	x
<i>Baeocrara vaga</i> Johnson, 1986	—	x
<i>Smicrus cinerascens</i> (Motschulsky, 1869) [= <i>S. filicornis</i> (Fairm. & Lab.)]	—	x
<i>Smicrus rivalis</i> Motschulsky, 1869 [= <i>S. filicornis</i> (Fairm. & Lab.)]	—	x
TOTAL: 33	17	16

Table 5. Complete list of Palaearctic species of Ptiliidae distributed also into extra-Palaearctic realms. NEA = Nearctic; NTR = Neotropical; AFR = Afrotropical; ORR = Oriental; AUR = Australian. * = species of strictly Holarctic distribution, not occurring outside. Order of names follows Sörensson (2015).

SPECIES NAME	NEA	NTR	AFR	ORR	AUR
<i>Kimoda globosa</i> Johnson, 1985	—	—	X	X	—
* <i>Ptenidium nitidum</i> (Heer, 1841)	X	—	—	—	—
<i>Ptenidium laevigatum</i> Erichson, 1845	—	—	—	—	X
<i>Ptenidium punctatum</i> (Gyllenhal, 1827)	—	—	—	—	X
<i>Ptenidium pusillum</i> (Gyllenhal, 1808)	X	—	—	X	X
<i>Bambara contorta</i> (Dybas, 1966)	X	X	X	—	—
<i>Bambara frosti</i> (Dybas, 1966)	X	X	X	X	—
* <i>Bambara fusca</i> (Dybas, 1966)	X	—	—	—	—
<i>Bambara invisibilis</i> (Nietner, 1856)	—	—	X	X	—
* <i>Millidium minutissimum</i> (Weber & Mohr, 1804)	X	—	—	—	—
* <i>Oligella foveolata</i> (Allibert, 1844)	X	—	—	—	—
* <i>Ptiliola brevicollis</i> (Matthews, 1860)	X	—	—	—	—
* <i>Ptiliola kunzei</i> (Heer, 1841)	X	—	—	—	—
* <i>Ptiliolum fuscum</i> (Erichson, 1845)	X	—	—	—	—
* <i>Ptiliolum spencei</i> (Allibert, 1844)	X	—	—	—	—
<i>Skidmorella magnifica</i> Johnson, 1971	—	—	—	—	X
* <i>Ptinella aptera</i> (Guerin-Méneville, 1839)	X	—	—	—	—
* <i>Ptinella britannica</i> Matthews, 1858	X	—	—	—	—
<i>Ptinella cavelli</i> (Broun, 1893)	—	—	—	—	X
<i>Ptinella errabunda</i> Johnson, 1975	—	—	—	—	X
* <i>Ptinella johnsoni</i> Rutanen, 1985	X	—	—	—	—
* <i>Ptinella mekura</i> Kubota, 1943	X	—	—	—	—
* <i>Ptinella populicola</i> Vorst, 2012	X	—	—	—	—
<i>Ptinella simsoni</i> (Matthews, 1878)	—	—	—	—	X
<i>Ptinella taylorae</i> Johnson, 1977	—	—	—	—	X
<i>Acrotrichis cephalotes</i> (Allibert, 1844)	—	—	X	—	—
* <i>Acrotrichis cognata</i> (Matthews, 1877)	X	—	—	—	—
<i>Acrotrichis fascicularis</i> (Herbst, 1793)	X	—	—	—	X
* <i>Acrotrichis henrici</i> (Matthews, 1872)	X	—	—	—	—
<i>Acrotrichis insularis</i> (Mäklin, 1852)	X	—	—	—	X
* <i>Acrotrichis intermedia</i> (Gillmeister, 1845)	X	—	—	—	—
<i>Acrotrichis josephi</i> (Matthews, 1872)	X	—	—	—	X
<i>Acrotrichis montandonii</i> (Allibert, 1844)	X	—	—	—	X
* <i>Acrotrichis parva</i> Rosskothen, 1935	X	—	—	—	—
<i>Acrotrichis sericans</i> (Heer, 1841)	X	X	X	—	X

<i>Acrotrichis setosa</i> Johnson, 1988	—	—	—	X	—
* <i>Acrotrichis silvatica</i> Rosskothen, 1935	X	—	—	—	—
* <i>Acrotrichis thoracica</i> (Waltl, 1838)	X	—	—	—	—
* <i>Acrotrichis volans</i> (Motschulsky, 1845)	X	—	—	—	—
<i>Acrotrichis grandicollis</i> (Mannerheim, 1844)	X	—	—	—	X
<i>Acrotrichis sanctaehelena</i> Johnson, 1972	—	—	X	—	—
<i>Acrotrichis cursitans</i> (Nietner, 1856)	—	—	X	X	—
<i>Actinopteryx fucicola</i> (Allibert, 1844)	X	X	X	—	—
<i>Actinopteryx parallela</i> Britten, 1926	—	—	—	X	X
<i>Actinopteryx reflexa</i> Britten, 1926	—	—	X	—	X
<i>Baeocrara parvula</i> Johnson, 1986	—	—	—	X	—
<i>Baeocrara vaga</i> Johnson, 1986	—	—	—	X	—
<i>Nephanes titan</i> (Newman, 1834)	X	—	X	—	X
<i>Smicrus filicornis</i> (Fairmaire & Laboulbène, 1855)	X	X	—	—	—
TOTAL: 49 [*20]	32	5	11	9	17

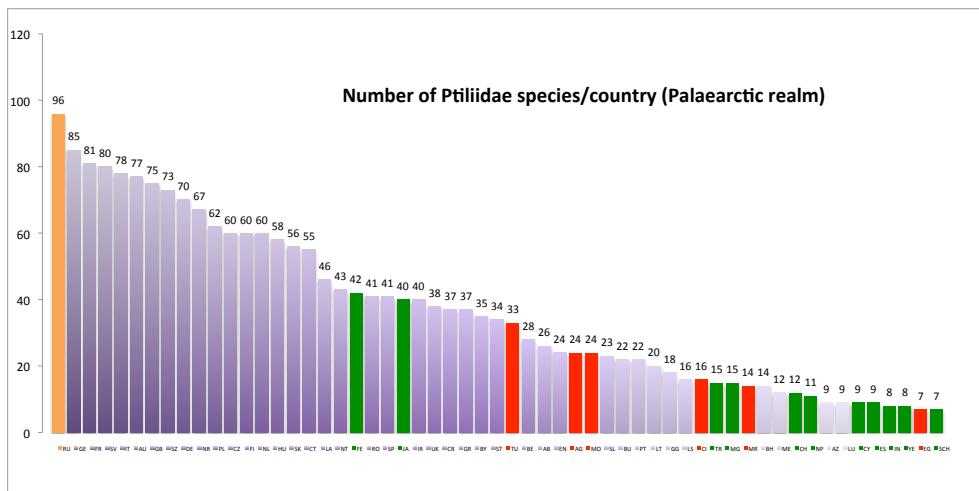


Fig. 1. Number of species of Ptiliidae per Palaearctic symbol (country, part of country or province), with 7 or more species recorded. Geographical division and symbols follow Löbl & Smetana (2004). Europe = lilac; North Africa = red; Asia = green; Russia (country) = orange; Russia (parts) lilac (NT, CT, ST) or green (ES, FE).

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